

Industrial-Strength Bayesian Reliability Analysis

Bayesian methods of reliability analysis are increasingly being used in industry as a means of combining all available information, such as engineering and qualification test data, previous data from similar systems, field experience, and expert judgement, to provide better estimates, at lower cost, of the reliability of a system or design. ***Bayesian methods often significantly reduce reliability testing costs with an accompanying improvement in the quality of the reliability estimates.*** Current and previous applications at Los Alamos National Laboratory that have achieved such cost savings and/or improvements include:

- Development of Bayesian sequential probability ratio test plans for Weibull uptime distributions for use in qualifying new roll-outs of large-scale industrial manufacturing processes.
- Development of Bayesian test plans that attain a specified probability of passing the test when a target reliability has been met. Provide desired confidence that the target reliability has been met in a test that has been passed.
- Development of Bayesian sequential probability ratio test plans for use in conjunction with nonstationary industrial manufacturing processes.
- Development of Bayesian data fusion methodologies for combining large, finite element code calculation output for mechanical performance of a process operation with limited test data.
- The use of Bayesian control charting methods to determine reliability trends and patterns over time.
- The use of empirical Bayes methods to forecast the long-run reliability of new, large industrial processes using existing data on similar processes in the presence of reliability growth.
- The use of Bayesian methods to determine the distribution of availability over time for nonstationary industrial processes in the presence of reliability growth.
- Development of Bayesian decision criteria for use in deciding whether or not a reliability goal has been attained.

Los Alamos National Laboratory

Group TSA-1, Statistical Sciences (<http://www-tsa.lanl.gov/tsa1/>)

Group Leader: Dr. Sallie Keller-McNulty (505) 667-3957; sallie@lanl.gov

Principal Investigator: Dr. Harry F. Martz (505) 667-2687; hfm@lanl.gov